TABLE 3.—*Monthly and annual mean precipitation, greatest and least annual and their ratio*—Continued

[The annual values have been rounded off to whole millimeters; monthly values in millimeters and tenths, Chinese stations]

Province and station	From	To	North latitude	East longitude	Elevation	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual			Ratio
																		Mean	Max.	Min.	
			° ′	° ′	*m.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
Kwangsi—Continued.																					
Silung [1]	1916	1926	24 27	105 30	(4)	13.9	23.0	40.3	58.8	170.5	286.8	264.0	290.8	156.7	70.4	48.3	21.7	1,445			
Souyen [1]	1916	1926	24 19	110 18	(4)	34.7	68.6	94.1	145.9	234.5	250.2	156.4	199.7	84.8	40.5	49.5	36.1	1,395			
Sunchow [1]	1918	1926	23 17	109 59	(4)	65.9	122.8	97.9	203.9	323.5	397.2	243.6	259.8	132.2	60.0	80.0	65.5	2,052	2,249	1,641	1.31
Szengenfu [1]	1918	1926	23 22	108 02	(4)	51.5	87.0	67.0	135.4	188.5	294.0	287.2	328.9	154.4	49.0	59.3	44.0	1,746			
Yungfu [1]			25 01	109 59	(4)	50.8	126.6	125.0	215.0	416.3	456.5	203.6	235.3	100.7	94.3	62.9	47.3	2,134			
Kwantung:																					
Breaker Point	1892	1924	22 56	116 30	17	27.9	47.2	57.1	109.9	201.0	286.8	210.7	270.9	169.2	99.4	37.4	31.5	1,549	2,190	715	3.06
Canton	1907	1924	23 07	113 16	15	49.6	75.0	75.7	148.5	254.2	264.7	271.3	282.5	134.6	63.2	44.4	35.5	1,699	2,796	1,102	2.54
Chilang Point	1911	1924	22 40	115 40	28	21.8	58.2	61.4	94.6	181.3	258.4	232.4	240.9	140.5	48.0	34.5	29.1	1,401	1,985	989	2.01
Lamocks	1892	1924	23 16	117 17	58	28.1	36.9	55.6	99.3	124.7	177.7	166.3	164.8	139.3	85.3	26.7	23.4	1,128	1,834	545	3.37
Macao	1910	1924	22 12	113 32	20(?)	22.1	51.0	64.7	121.8	307.7	338.6	235.7	253.0	172.9	112.6	54.7	26.4	1,761	2,375	1,305	1.82
Pakhoi	1885	1924	21 29	109 07	5	32.0	33.1	76.0	107.2	171.1	292.8	503.0	506.6	272.5	81.2	45.4	48.4	2,169	3,962	1,389	2.85
Hong Kong	1884	1924	22 18	114 10	32	32.7	44.5	68.0	134.9	304.2	402.5	356.0	371.9	247.0	130.1	43.2	27.3	2,162	3,041	1,164	2.67
Samshui	1900	1924	23 06	112 53	10	41.8	65.5	112.3	184.3	305.0	267.7	243.5	260.7	143.4	69.5	47.6	45.9	1,787	2,401	1,044	2.30
Swatow	1880	1924	23 23	116 40	4	35.3	62.5	79.9	143.5	229.5	266.6	197.8	212.2	138.5	73.0	39.4	38.1	1,516	2,512	670	3.75
Kwangchowwan [1]	1913	1925	21 05	108 10	14	15.7	28.6	42.8	76.6	171.2	214.5	220.4	310.5	185.5	59.7	52.7	28.7	1,407	1,715	1,133	1.51
Liuchow [1]	1921	1926	24 53	112 57	(4)	40.1	105.1	131.4	195.7	309.6	250.8	148.3	129.3	58.4	86.9	42.8	27.1	1,526			
Nanyung [1]	1919	1926	25 16	114 04	(4)	53.8	125.7	152.8	229.4	245.5	271.3	99.7	204.4	83.6	80.6	34.3	34.4	1,616			
Sheklung [1]	1920	1926	23 05	113 59	(4)	41.1	108.7	109.7	179.5	256.6	252.1	272.0	302.4	139.8	39.5	59.5	14.8	1,776			
Shiuchow [1]	1919	1926	24 55	113 08	(4)	38.1	119.7	123.7	202.3	271.0	267.7	84.1	170.5	73.8	62.0	23.8	33.5	1,470			
Yintuk [1]	1919	1926	24 10	113 19	(4)	47.8	120.1	133.5	278.3	314.5	340.6	148.7	248.2	92.8	60.9	30.0	27.9	1,843	2,553	1,482	1.72
Hainan (Island):																					
Kiungchow	1912	1924	20 01	110 16	10	25.2	26.0	72.2	94.1	174.6	209.8	247.2	207.2	258.2	190.6	83.1	59.0	1,647	1,829	1,500	1.22
Lamko	1912	1924	20 00	109 42	15	16.1	17.7	39.1	55.5	83.5	129.1	200.8	211.3	194.3	125.7	50.0	27.2	1,150	1,518	707	2.15

[1] Seconday station. [4] Not known accurately.

RAPID DECREASE IN BAROMETRIC PRESSURE NORTHWEST OF STORM TRACK ON NOVEMBER 17, 1928

551.54 (77)

By W. S. BELDEN

[Weather Bureau, St. Joseph, Mo.]

A rapid decrease in barometric pressure occurred in southeastern Kansas, northwestern Missouri, and south-central Iowa on the morning of November 17, 1928, in connection with the northeastward movement of a cyclonic area that was central near Columbia, Mo., at 7 a. m., ninetieth meridian time, on that date.

The fall in pressure at St. Joseph, Mo., was 0.25 inch in 40 minutes, from 4:50 a. m. to 5:30 a. m., as shown in Figure 1. Similar though slightly less pronounced falls were registered at Wichita and Iola, Kans., Kansas City, Mo., and Des Moines, Iowa. The time of the earliest abrupt fall was 1:30 a. m. at Wichita. Then followed in order rapid falls at stations to the northeastward, Des Moines being reached at 8:30 a. m.

Although St. Joseph was approximately 150 miles northwest of the storm track, its lowest pressure, reduced to sea level, was lower than any other sea-level pressure reported in the cyclonic area west of the Mississippi River. See accompanying table of data.

In or near and to the south of the storm track recorded pressure falls were generally gradual. The greatest in two hours ranged from 0.06 to 0.13 inch, except at Columbia and Springfield, Mo., where the sharpest decreases, amounting to 0.10 inch in each case, came within about one hour, and at the apparent time of the nearest approach of the storm center. In Nebraska and western and north-central Kansas pressure changes attending the passage of the storm were not unusual.

The decided pressure decreases were each accompanied by northerly surface winds, the highest velocity being 32 miles an hour from the northeast at Wichita.

Excessive rainfall, mostly in the northeast quadrant of the cyclone, occurred over a belt approximately 100 miles wide extending from northcentral Oklahoma northeastward to southeastern Iowa. Thunderstorms were general in Oklahoma, Kansas, Missouri, and Iowa on the 16th but the only stations reporting thunderstorms on the 17th were Wichita and Kansas City.

Temperatures were much above normal in Missouri and adjacent States on the 16th, and in the central, southern, and eastern portions of Missouri on the morning of the 17th, when the temperature ranged from 40° at St. Joseph to 60° at St. Louis.

The lowest observed sea level pressure readings appear on Figure 2. Isobars show that over most of Missouri and southeastern Iowa the minimum pressure was less than 29.60 inches, with three centers of low pressure.

Hour lines indicating the progressive movement of the abrupt falls in pressure appear on Figure 3. The lines for 9 a. m., 10 a. m., and 11 a. m. have been drawn not for the lowest readings, but for slight sharp falls, which seem to be directly associated with the more abrupt falls. The lowest pressure readings at Hannibal, Keokuk, Davenport, and Dubuque were in each case registered later than the slight sharp falls. At Oklahoma City the lowest barometer reading occurred at 5 p. m. November 16, the time of the nearest approach of the center of the storm area, but after the barometer had risen gradually for more than four hours, a fall of 0.08 inch was registered within 30 minutes ending at 10:10 p. m. This slight sharp fall also seems to be associated with the more abrupt falls, thus giving a basis for beginning the hour lines at 10 p. m. November 16.

A secondary atmospheric whirl of much intensity but somewhat limited diameter appears to have developed aloft over central Oklahoma about 10 p. m. November 16.

38673—29——2

The course of the secondary disturbance was to the northeastward, as indicated by arrows that cross the hour lines in Figure 3. It passed near or over St. Joseph, causing a remarkably rapid fall in pressure, and spent nearly all of its energy before reaching extreme east-central Iowa. Its rate of movement seems to have been greater than the rate of advance of the primary storm area.

It should be noted that (1) the lowest pressure at Kansas City was 0.09 inch higher than the lowest pressure at St. Joseph, thus giving evidence of a ridge of pressure between the primary and secondary depressions; (2) the direction of surface winds was not materially affected by the passage of the secondary whirl; (3) the velocity of surface winds was not as great as that which usually attends such wide fluctuations in pressure; and (4) assuming that the atmospheric whirl existed aloft, as outlined, it would not have been subject to the retarding influence, experienced by the primary cyclonic area, resulting from friction with the ground.

Pressure and wind conditions on November 16–17, 1928

Stations	Lowest barometer (sea level)	Time	Greatest fall in pressure within 2 hours	Maximum wind velocity, direction, and time
Nov. 16				
Oklahoma City, Okla.	29.65	5:00 p. m.	0.08	20, N., 9:34 p. m.
Fort Smith, Ark.	29.72	10:00 p. m.	.06	30, SW., 10:04 p. m.
Nov. 17				
Wichita, Kans.	29.64	1:30 a. m.	.20	32, NE., 1:36 a. m.
Iola, Kans.	29.58	2:00 a. m.	.17	19, N., 7:24 p. m. (16th).
Concordia, Kans.	29.92	7:10 a. m.	.07	24, NW., 9:43 a. m.
Springfield, Mo.	29.58	5:00 a. m.	.13	28, W., 11:31 a. m.
Columbia, Mo.	29.54	7:00 a. m.	.10	23, SW., 12:35 p. m.
Kansas City, Mo.	29.61	5:00 a. m.	.17	30, NE., 5:30 a. m.
St. Joseph, Mo.	29.52	5:30 a. m.	.27	25, NE., 5:22 a. m.
Omaha, Nebr.	29.85	7:00 a. m.	.09	28, N., 6:45 a. m.
Des Moines, Iowa.	29.62	8:30 a. m.	.21	22, N., 8:36 a. m.
Charles City, Iowa.	29.77	12:00 noon	.12	17, NE., 11:35 a. m.
La Crosse, Wis.	29.76	12:30 p. m.	.10	11, N., 10:34 a. m.
Davenport, Iowa.	29.53	1:00 p. m.	.09	
Dubuque, Iowa.	29.60	1:45 p. m.	.13	18, N., 5:12 p. m.
Keokuk, Iowa.	29.57	12:00 noon	.06	18, NE., 3:28 p. m.
Hannibal, Mo.	29.55	12:30 p. m.	.06	28, SW., 2:16 p. m.
St. Louis, Mo.	29.63	10:00 a. m.	.07	36, W., 4:23 p. m.

NOTE

A somewhat similar phenomenon occurred on February 20, 1927, between 4 and 5 a. m. at the New York station. Mr. Gerald J. O'Connor brought this matter to the attention of the central office and remarked that he had noted a similar occurrence on May 12, 1923. In the February, 1927, case the temperature was steady at about 24°, with sleet and rain and fresh easterly winds. The barograph trace showed a sudden fall of 0.10 inch and a rise of 0.09 inch, both within the hour, 4 to 5 a. m. Similar but less accentuated conditions were noted as follows: Atlantic City, 3 a. m.; Philadelphia, 3 a. m.; Trenton, 3 to 4 a. m.; Sandy Hook, 4:15 a. m.; New York. 4:15 a. m.; Block Island, 11:15 a. m.; Providence, 11:30 a. m. But the traces at Washington, Baltimore, Harrisburg, Reading, Scranton, and New Haven showed nothing of this kind.

With steady temperatures and persistent northeast winds, without any shift at the surface, we naturally have recourse to the conditions in the free air. From the fact that sleet was falling it may be inferred that a warm current existed aloft, probably from the southwest or south.

A high-pressure area of 30.9 inches was central over the Gulf of St. Lawrence, with a low 29.75 inches over extreme eastern Tennessee, and another of 29.75 inches on the Virginia coast. From the latter center a line of discontinuity extended approximately eastward off the coast. From this line, a surface of discontinuity sloped northward in the free air, as indicated by the fact that it was sleeting at New York. No doubt along this surface there was considerable mixing due to turbulence and it seems probable to Professor Humphreys and myself that a small disturbance passed over New York City in the free air in this turbulent layer. If we take the distance from Atlantic City to New York as 100 miles and the time interval as 1 hour and 45 minutes, the rate of travel of the disturbance was in the neighborhood of 55 to 60 miles per hour.

A phenomenon of this character has also been noted by Sir Napier Shaw in his Forecasting the Weather, first edition, pages 253, 254.—*R. H. Weightman.*

A DENSE SMOKE CLOUD ON JANUARY 3, 1929, AT WASHINGTON, D. C.

551.510.4 (753)

By IRVING F. HAND

[Weather Bureau, Washington, January 9, 1929]

Cold mornings with little or no wind and consequent piling up of city smoke have been productive of many noteworthy smoke clouds which have passed over the Solar Radiation Observatory of the Weather Bureau, located on the campus of the American University in the northwest suburbs of Washington,[1] but none heretofore has yielded as many dust particles as the cloud which passed over this section of the city about 9:30 a. m., January 3, 1929. The American University is located about 2 miles from Georgetown, an industrial center of Washington, 4 miles northwest of the White House, and 5 miles from all important railroads.

Table 1 shows in condensed form the number of dust particles collected by both the Owens [2] and Hill [3] dust counters, together with certain meteorological data. Not only was the number of these particles the maxima ever obtained in Washington, but their size averaged about 0.0015 mm. in diameter, or about twice the diameter of those usually collected.

TABLE 1.—*Number of dust particles and meteorological data during the passage of a dense smoke cloud over northwest Washington, January 3, 1929*

Time	Number of dust particles			Temperature	Rel. hum.	Vapor pressure	Wind		Visibility	
	Owens counter		Hill counter				Direction	Velocity	West	East
	Per cu. cm.	*Per cu. ft.*	*Per cu. ft.*	*°F.*	*Per cent*	*Inch*			*Miles*	*Miles*
8:00 a. m.	638	18,066,246	18,788	24	64	0.063	0	0	12	>1
9:30 a. m.	12,810	363,637,470	469,700	27	53	.076	S.	2	3	¼
Ratio 9:30 a. m. / 8:00 a. m.		20.1	25.0							

[1] Mo. Wea. Rev., 1925, 53: 147–148. Mo. Wea. Rev., Jan., 1926, 54: 19–20.
[2] Mo. Wea. Rev., Mar., 1924, 52: 133–139.
[3] It collects the particles in a measured quantity of air by causing them to impinge upon the object glass of a microscope, the surface of which is covered by a thin coating of white vaseline.

The ratio of the 9:30 a. m. to the 8 a. m. measurements by each instrument indicates a greater increase in